EFFORTS TO IMPROVE TREATMENT STANDARDS

The treatment of syphilis is subject to a limited degree of standardization. A special bulletin is being issued by the State Department of Health in which the modern treatment of syphilis is described. Copies of this bulletin are to be disseminated among clinics and physicians of the State. A second bulletin outlining modern trends of treatment of gonorrhea is being prepared. It is hoped that with these efforts, together with wide publicity, the general standard of treatment of venereal diseases throughout the State can be materially raised.

An effort will be made to eliminate the prenatal transmission of syphilis. Publicizing the necessity for blood Wassermanns in every pregnant woman is planned.

ADEQUATE EPIDEMIOLOGIC WORK IMPORTANT

Next to treatment, adequate epidemiologic work is probably most important. By a recent ruling of the State Board of Public Health, the morbidity report cards have been changed. Through publicity, education and appeals to coöperation, as well as legal measures where indicated, physicians will be encouraged to report all cases of venereal diseases. In addition to sending in morbidity report cards on each case, all clinics will be required to send monthly reports to the State Department. Laboratory reports will not be accepted as case reports, but will be used only for checking purposes.

Physicians are required by law to report venereal diseases. In addition, they are to report to health officers any cases lapsing from treatment while still in the infectious stage of the disease. The health officer shall then see that the patient is returned to treatment, enforcing quarantine and isolation in a hospital if necessary. The health officer is also responsible for keeping clinic patients under treatment until rendered non-infectious.

It is desired that every early case of venereal disease shall receive a complete epidemiologic investigation. This will include investigation into the source of infection and all possible contacts. Efforts will be made to bring these contacts in for examination and, if necessary, for treatment. In addition, efforts are to be extended to keep patients under treatment for the required length of time.

STATE BACTERIOLOGIC LABORATORY

The State bacteriologic laboratory will pursue essentially the same course that it has in the past by running tests for all State institutions and certain other private agencies. As in the past, tests will be run on specimens from private patients who are unable to pay for such services, provided these specimens originate in districts not taken care of by local health department laboratories. As in the past, the State bacteriologic laboratory will be available for checking and standardizing of tests run by any laboratory in the State. The plan is not to extend the State bacteriologic laboratory's activities, but to use them, in so far as is possible, to bring up the general standards of laboratory service throughout the State.

EXTENSIVE EDUCATIONAL PROGRAM PLANNED

An extensive informative educational program is being outlined. As indicated above, special bulletins are being prepared for physicians. In cooperation with the state and county medical societies, special courses in diagnosis and treatment of venereal diseases are being outlined for presentation to county medical society groups. A number of county medical societies are proceeding with plans of their own in this respect. It is hoped that special courses can be arranged in medical schools for physicians who are interested in obtaining additional information relative to these diseases. In an effort to obtain more definite information concerning the incidence of these infections, surveys will be run from time to time throughout various districts of the State. Questionnaires have already been sent out to several counties.

Literature is being prepared and accumulated for distribution to patients by physicians and clinics. Informative programs for the general public are being prepared. These will include newspaper publicity, lectures, pamphlets, posters, radio addresses, etc. The general public is to be informed particularly concerning the economic costs and benefits from control of these diseases.

In conclusion, it may be stated that the constituted public health authorities of California have in mind a venereal disease program that will aid, in fullest measure, the eradication of venereal disease, but along lines that will not make for confusion or low-standard results through officious meddling with the work of licensed physicians in private practice.

State Office Building, McAllister and Larkin streets.

THE EXTENSIVE SIDE-ACTIONS OF BARBITALS AND THEIR TREATMENT*

By P. J. HANZLIK, M.D.
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DISCUSSION *by C. H. Thienes, M.D., Los Angeles; C. D. Leake, Ph. D., San Francisco; Fred B. Moor, M.D., Los Angeles.*

THE object of this paper is to draw attention to actions of barbitals which are oftentimes overlooked in the enthusiastic reception of some highly exploited use, such as the intravenous for analgesia or anesthesia. The actions referred to are the undesired side-actions, some of which are unavoidable in the ordinary uses of barbitals. They shed a light on the irregularities in actions and the physiologic disturbances met with in the use of these drugs.

Since 1929, I have been in the habit of demonstrating to medical students three graphic records which illustrate depression and paralysis of peripheral neuromuscular elements in the autonomic system caused by amytal. They are presented here in Figures 1, 2, and 3, which illustrate depression of the circulation, vagal ganglia, and intestines, respectively. The results illustrated in Figures 1 and 2 agree in all essential respects with recent reports of Koppanyi and coworkers,[1] and are to be regarded as confirmatory. The same holds true

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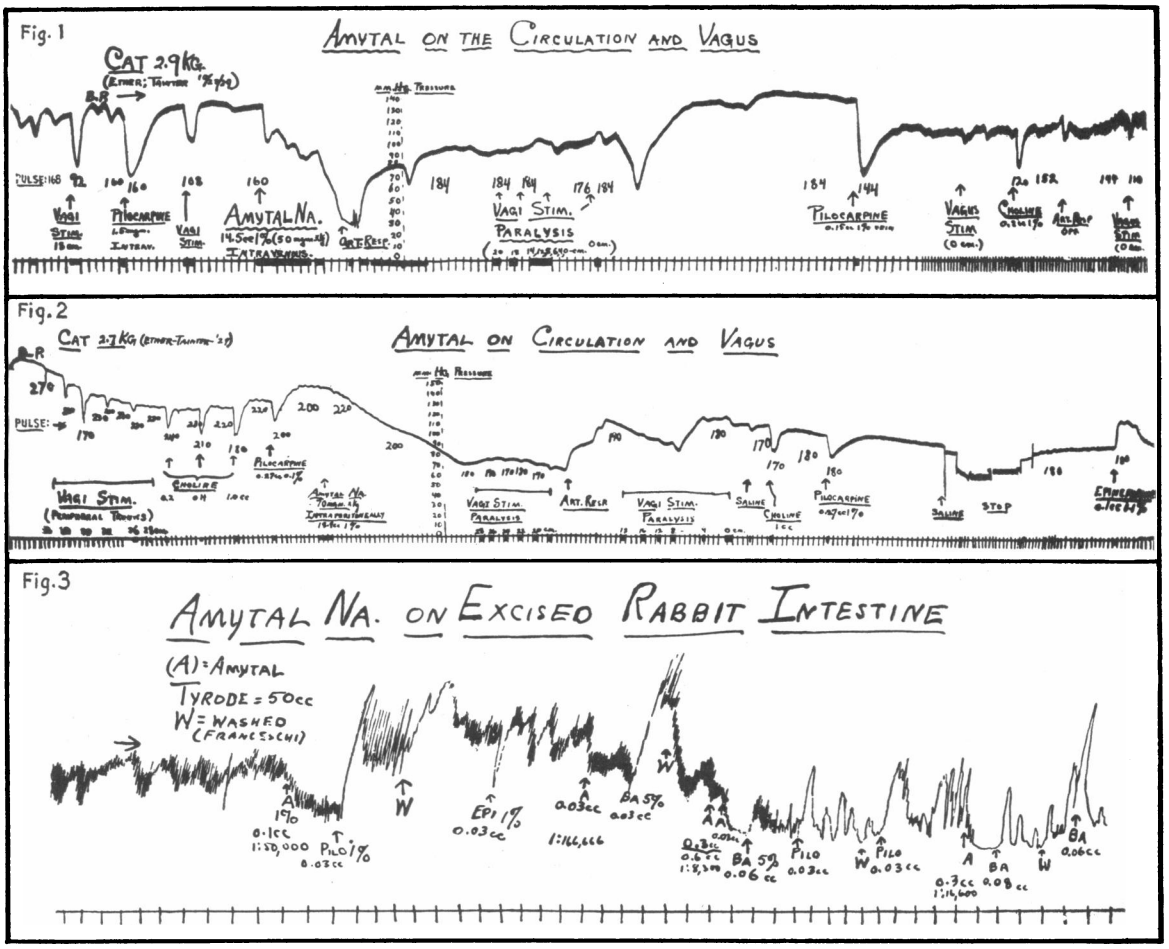

Fig. 1.—Amytal intravenously in a cat. Depressant effects on blood pressure, pulse rate and vagus ganglia are shown; pilocarpin and cholin, effective before and after amytal; collapse required artificial respiration.

Fig. 2.—Amytal intraperitoneally in a cat. Depressant effects on blood pressure, pulse rate and vagus ganglia are shown; cholin and pilocarpin effective before and after amytal, epinephrin after amytal; artificial respiration for the depression.

Fig. 3.—Amytal on excised intestine of a rabbit. Weakened reactions to pilocarpin, epinephrin and especially barium, as stimulants for autonomic nerves and muscles are shown.

for the results in Figure 3, which confirm the work of others. These confirmations clinch the evidence experimentally and dispose of some uncertainties about the nature of the side-actions.

CIRCULATORY AND VAGAL GANGLIONIC DEPRESSION

The legends on Figures 1 and 2 are self-explanatory as to the occurrence of events in two cats receiving injections of sodium amytal in so-called anesthetic dosage—one intravenously, the other intraperitoneally. Briefly recapitulated, the phenomena are as follows: depressor or collapse action (fall of blood pressure); paralysis of vagus control of the heart without loss of function in the peripheral receptive mechanism (ineffective vagus stimulation; fall of blood pressure and bradycardia from cholin and pilocarpin); absence of central and peripheral vasomotor paralysis (recovery of blood pressure, and pressor action of epinephrin, positive); cardiac depression suggested by bradycardia or tachycardia, with constant loss of vagus control; reflex cardiac slowing improbable (ineffective peripheral vagus stimulation). Presumably, direct cardiac depression is the cause of the circulatory collapse. A justifiable conclusion is ganglionic paralysis or synaptic block in the cardiac vagi, an action of the amytal paralleled commonly by such poisons as nicotin and lobelin, and sometimes by cholin. This paralytic action has been further analyzed and conclusively demonstrated pharmacodynamically by Koppanyi, Dille, and Linegar.[1] It does not require intravenous injection of a barbital.

The ganglionic paralysis blocks the transmission of both efferent and afferent impulses in the cardiac vagi, and in case blockage extends to other branches of the vagi, and parasympathetic nerves in general, this action of barbitals interferes with visceral reflexes, some of which are protective, such as vomiting and coughing. On the other hand, the ganglionic paralysis, together with the central depression of a barbital, would make an effective combination for controlling asthmatic attacks of reflex origin.

INTESTINAL DEPRESSION

All the functional elements in a strip of excised rabbit intestine are included in the depression, the muscles perhaps more than the nerves (Figure 3). Muscular depression is shown by a progressive decrease in tone and rhythmic activity, and in re-

action to barium. The autonomic nerves reacted satisfactorily to pilocarpin and epinephrin after poisoning with amytal in low (1:50,000) concentrations, as compared with unpoisoned intestines (not shown here). But after high concentrations (1:8000), the reactions to the same poisons rapidly declined. The concentrations of amytal used for demonstrating these depressant actions were higher than those attainable in the same tissues after oral administration of amytal. However, the moderate depressions of the low concentrations indicate effects of anesthetic doses of amytal given intravenously, and those of higher concentrations of repeated and toxic injections. They are confirmatory of depressant effects described by Gruber[2] for a number of barbitals in a considerable range of concentrations, and those of Quigley, Barlow, and Himmelsbach,[3] using the intact gastro-intestinal tract.

For sake of completeness, the following list of side-actions is recorded: gastro-intestinal flaccidity and reduced peristalsis, decreased intestinal absorption of dextrose, decreased consumption of sugar by skeletal muscles, decreased urine secretion, alarming restlessness, delirium or stupor, paresis of the tongue, cyanosis and asphyxia, skin rashes, arsenic-like paralysis of capillaries, pulmonary congestion and edema, mucoid degeneration of the brain;[4] depression of the spinal cord and reflexes, emphasized recently again by Porter and Allamon;[5] blood-destruction and anemia with intravenous anesthetic doses of evipal, a much-exploited barbital at the present time;[6] increased blood sedimentation and reduced cell volume with slow return to normal after a number of barbitals and evipal;[7] very marked reduction of urine output in nephritis;[8] cardiac irregularities after barbital;[9] persistent depression or paralysis of vasomotor reflexes (aorta and carotid sinus) and centers with marked respiratory depression after evipal;[10] precipitation of barbitals in the blood stream with intravenous activation of reflexes from the trunk, aorta, and carotid sinus, resulting in circulatory and respiratory disturbances;[11] extensive avascularity of central nervous tissue with reduced blood supply to the brain, muscles, and skin after dial and amytal;[12] damage of cerebral blood vessels and parenchyma after continued daily doses of barbital;[13] fatty degeneration of liver, kidneys, heart and lungs after nostal;[14] predisposition to intercurrent disease in barbital habitués.[15] Use of barbitals in obstetrical practice is in a controversial state; more and better studies of their actions are needed. Placenta is not a barrier to barbitals, as they are readily demonstrated in the fetus, narcotized babies are not infrequent, and continued use may result in abortion.[16] Dodek's[17] clinical studies of uterine contractions indicate that amytal by mouth does not retard labor, but Rawlings[18] states that nembutal may, and Gruber[19] has reported depression of excised strips. This list is not intended to be exhaustive, but is sufficiently complete to leave no doubt of the complications which may attend the use of barbitals.

Many of the reported side-actions occur with doses of anesthetic range, some with toxic doses, such as capillary paralysis, edema, and nerve and parenchymatous degenerations. While most of the actions have been demonstrated in animals, there is every reason to believe they can occur in humans. They should be given careful consideration in connection with clinical uses, especially the intravenous. It should not be forgotten that man is generally more susceptible to hypnotic drugs than are animals, and therefore reacts to smaller doses.

Collectively, these actions emphasize the fact that the barbitals cause widespread depression or paralysis of living tissues in varying degree. In other words, they cause general protoplasmic poisoning, and are not as selective in their actions as is sometimes claimed. It follows that the use of barbitals, as aids in systemic or local anesthesia, is fraught with certain dangers and that there is no such thing as a nontoxic sedative or anesthetic which may be used with impunity. Some of the side-actions might easily obscure or confuse a diagnosis, and affect a patient's recovery from a disease in which the barbital was exhibited merely as a symptomatic or palliative measure. Conceivably, some of the side-actions might be desired or even useful, such as ganglionic depression in controlling reflex excitability, vomiting, asthmatic attacks, etc. On the whole, however, they are probably always objectionable in connection with the ordinary uses of barbitals. They should always be kept in mind in relation to the general condition of a patient. The high order of efficiency of some, such as evipal, is apparently related to their paralytic potentialities.

TREATMENT

The minor side-actions do not necessarily require treatment. The major phenomena approaching or resulting in collapse necessitate attention. The general depressant effects of the barbitals call for measures used in the treatment of collapse. Stopping of the medication is first in order. Removal of the barbital, when swallowed, by gastric lavage with warm potassium permanganate (1:1000) should be attempted. Alkalies should not be used, as they promote solution and absorption. Charcoal, four tablespoonsful for an adult, is given after gavage and not removed. Apply external heat; raise the head to avert bronchopneumonia; catheterize, if necessary, and save urine for barbital test. Dextrose solution, 5 per cent, or ammonium chlorid, 1 per cent, in physiologic salt solution may be given gastrically, hypodermically, rectally, or intravenously; this promotes diuresis and excretion of barbitals. For circulatory and respiratory depression, caffein 0.5 gram, strychnin 1 milligram, or digitan 1 cubic centimeter hypodermically; tyramin 50 milligrams or neosynephrin 50 milligrams, hypodermically or intramuscularly, in preference to epinephrin, which is too fleeting in action, and to ephedrin, which depresses the heart; carbon dioxid-oxygen inhalation. The new antidotes, picrotoxin and metrazol together, as powerful central stimulants, are being tried clinically with some success:[20] picrotoxin intravenously, in single doses of 10 milligrams up to a total of about 160 milligrams, and metrazol

intravenously, in single doses of 400 milligrams up to a total of about 2500 milligrams, in twenty-four to forty-eight hours, both drugs to be used cautiously. Cautious use of physostigmin, 0.5 to 2 milligrams, should promote restoration of vagal, gastro-intestinal and muscular functions. Intravenously injected, barbitals are not retrievable, but the various systemic, resuscitative, and excretory measures should be used vigorously. Cerebrospinal drainage may be tried to relieve pressure and to remove barbital when coma is present.

CONCLUSIONS

Barbitals are capable of producing widespread depression and paralysis of living tissues. In other words, they cause general protoplasmic poisoning, and are not particularly selective in their actions. Many of these actions are to be regarded as undesired side-actions accompanying the use of ordinary doses, others are the result of continued and extratherapeutic or toxic doses. Attention should be given to the side-actions, and caution exercised in the clinical use of barbitals. Treatment of the major depression and toxic phenomena is outlined.

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REFERENCES

1. Koppanyi, T., Dille, J. M., and Linegar, C. R.: Studies of barbiturates. XVII. The effect of prolonged chloroform anesthesia on the duration of action of barbiturates, J. Pharm. Exp. Therap., 58:119, 1936. Linegar, C. R., Dille, J. M., and Koppanyi, T.: Studies on barbiturates. XVIII. Analysis of a peripheral action of barbiturates, J. Pharm. Exp. Therap., 58:128, 1936.

2. Gruber, C. M.: A comparison of the effects of sodium isoamylethyl barbiturate (sodium amytal) and of sodium N-hexylethyl barbiturate (ortal sodium) upon the intact intestine in the unanesthetized dog, J. Pharm. Exp. Therap., 56:432, 1936. Gruber, C. M., Scholten, R., DeNote, A., and Wilson, J. F.: A comparative study of effects of sodium N-hexylethyl barbiturate (ortal sodium and of sodium isoamylethyl barbiturate (sodium amytal) upon excised smooth muscle, J. Pharm. Exp. Therap., 56:341, 1936.

3. Quigley, J. P., Barlow, O. W., and Himmelsbach, C. K.: Correlation of visceral and somatic activity following administration of hypnotics (A) Barbital compounds, and (B) Tribromethanol (avertin-crystals and fluid), J. Pharm. Exp. Therap., 50:425, 1934.

4. Report, Council on Dental Therapeutics: Uses and abuses of barbitals, J. Am. Dent. Assn., 18:152, 1931.

5. Porter, E. L., and Allamon, E. L.: Barbiturate-strychnin antagonism in the spinal cat. A quantitative study, J. Pharm. Exp. Therap., 58:178, 1936.

6. Dallemagne, M. J.: Contribution à l'étude des troubles post-anesthèsiques de l'équilibre acide-base, Arch. Intern. Med. Exp., 10:379, 1935.

7. Dorfman, R. I., and Brooks, C.: The effect of the barbiturates on the rate of sedimentation of red blood corpuscles, J. Pharm. Exp. Therap. (Proc.), 57:119, 1936.

8. Argy, W. P., Linegar, C. R., and Dille, J. M.: Studies on barbiturates. XV. The excretion of barbital in normal and nephropathic subjects, J. Pharm. Exp. Therap., 57:258, 1936.

9. Dikshit, B. B.: The production of cardiac irregularities by excitation of the hypothalamic centers, J. Physiol., 81:382, 1934.

10. Nowak, S. J. G.: Influence de l'alcool tribromoethylique et de dérives nouveaux de l'acide barbiturique (Malonyluree) sur la régulation automatique et reflexe de la pression artérielle et sur la respiration, Compt. rend. Soc. biol., 116:642, 1934.

11. Report, Council on Pharmacy and Chemistry: Intravenous use of barbital compounds, J. A. M. A., 97:1886, 1931.

12. Fulton, J. F., Liddell, E. G. T., and Rioch, D. McK.: "Dial" as a surgical anesthetic for neurological operations; with observations on the nature of its action, J. Pharm. Exp. Therap., 40:423, 1930.

13. Seevers, M. H., and Tatum, A. L.: Chronic experimental barbital poisoning, J. Pharm. Exp. Therap., 42:217, 1931.

14. Holck, H. G. O., and Cannon, P. R.: On the cause of the delayed death in the rat by isopropyl betabromallyl barbituric acid (nostal) and some related barbiturates, J. Pharm. Exp. Therap., 57:289, 1936.

15. Chopra, R. N., and Chopra, G. S.: Habitual use of barbituric acid derivatives in India, Indian Med. Gaz., 70:65, 1935.

16. Dille, J. M.: Studies on barbiturates. IX. The effect of barbiturates on the embryo and on pregnancy, J. Pharm. Exp. Therap., 52:129, 1934.

17. Dodek, S. M.: A new method for graphically recording the contractions of the parturient human uterus. A study of the effect of certain sedatives, anesthetics, and stimulants upon the uterus in labor, Surgery, Gyn., and Obs., 55:45, 1932.

18. Rawlings, W. J.: The use of nembutal in childbirth, Med. J. Australia, 2:5, 1935.

19. Gruber, C. M.: The influence of barbituric acid, of some benzyl derivatives and of the pH of fluids on the tonus and rhythmic movements of excised segments of intestine, uterus and ureters, J. Pharm. Exp. Therap., 30:149, 1926.

20. Koppanyi, T., Linegar, C. R., and Dille, J.: XIX. Analysis of the Barbiturate-Picrotoxin Antagonism, J. Pharm. Exp. Therap., 58:199, 1936.

DISCUSSION

C. H. THIENES, M. D. (Department of Pharmacology, University of Southern California, Los Angeles).—Professor Hanzlik's article should be especially important to surgeons and anesthetists, for his summary of the literature on the side actions of the barbituric acid derivatives is remarkably complete. I wish to add, however, one more item to the list, namely, the tremors and clonic convulsions frequently seen in evipal anesthesia, but not referred to in the literature that has come to my attention. In experimental animals, such tremors, closely simulating the shivering due to a cold environment, are produced by amytal, pentobarbital and other barbiturates. In the human, as well as in animals, increasing the dose abolishes the tremor, but such dosage increase is often hazardous.

There is no agreement among surgeons and anesthetists as to the values and dangers of the preanesthetic use of compounds of this class. For example, many urologists have abandoned the use of barbiturates preceding spinal anesthesia, while the majority of gynecologists insist on such premedication. There is some experimental basis for the use of barbiturates as premedication for inhalation anesthesia, especially ethylene and nitrous oxid, and for procain or cocain. Pontocain and nupercain are gaining popularity, but interest in the possible value of barbiturate premedication for these anesthetics is almost wholly lacking.

Sound clinical evidence for the safety and value of barbiturate medication preliminary to spinal anesthesia is greatly needed. Parallel studies will have to be made in large clinics, with and without premedication, using similar types of case in ample numbers, before a choice of preanesthetic procedure can be established with confidence.

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C. D. LEAKE, Ph. D. (University of California Medical School, San Francisco).—With the increasing use of barbitals, and with the increasing commercial pressure behind the attempted clinical introduction of new ones, Professor Hanzlik's warning regarding their unappreciated side-actions is most timely. While the characteristic effect of the barbitals is to depress the central nervous system, physicians must remember that, in applying this fact to the relief of insomnia, they are also bound to depress other tissues of their patients. The barbitals are not selectively depressant to the central nervous system as is commonly believed. Professor Hanzlik has clearly indicated the wisdom of considering all phases of the action of any drug in applying such action clinically.

Much is being made commercially, in the rapid recovery from central depression, of such new barbitals as "pento-

barbital," or "nembutal," and "evipal." There is strong likelihood that some of the undesired side-actions mentioned by Professor Hanzlik may greatly outlast the central depressant effect. Dr. Mary Montgomery, in our surgical laboratory, has clearly shown how the salivary and gastric secretion may be greatly depressed for several days after recovery from an "amytal" narcosis (*Proc. Soc. Exper. Biol. Med.*, 32:1287, 1935). This observation affords further evidence in support of Professor Hanzlik's thesis.

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FRED B. MOOR, M. D. (312 North Boyle Avenue, Los Angeles).—The autonomic nervous control of the heart lends itself well to a pharmacodynamic demonstration such as Doctor Hanzlik has so clearly presented. Utilizing this mechanism, the author has shown that the barbiturates depress the autonomic ganglia, both parasympathetic and sympathetic, in a manner resembling nicotin. There is associated with this a direct depression of cardiac muscle. Koppanyi and his associates have demonstrated similar depression of the nerve supply of the heart with several other members of the barbital group.

Again, in the isolated intestine, muscle and sympathetic and parasympathetic innervation are all depressed. Probably of more significance is the fact that Gruber and others were able to produce the same depression of the intestine in the intact animal with dosages of the barbitals which fall within the range of human anesthesia. We may assume, therefore, that definite depression of the visceral and nervous elements of the cardiac and gastro-intestinal mechanisms occurs with the intravenous injection of the barbital derivatives in the human.

Fortunately, the use of the longer-acting members of the barbital group, such as sodium amytal and pentobarbital sodium, has waned. The popularity of the shorter-acting ones, such as evipal and pentothal, seems to be growing. Some anesthetists manifest considerable enthusiasm for the latter in spite of occasional serious reactions. They are convenient for various minor surgical procedures, and are usually pleasant for patients. In view of reported pathologic effects, the widespread use of even these shorter-acting barbitals does not seem desirable, at least not until they have been given more study. Once injected they are beyond recall, and are not susceptible to the same control as inhalation anesthetics.

The intravenous injection of the barbiturates may be life-saving in poisoning by strychnin and the local anesthetics. In the case of the latter, however, smaller prophylactic oral dosage should precede the local anesthetic.

LEAD ENCEPHALITIS

PRECIPITATED BY ACUTE INFECTION

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DISCUSSION *by Hartzell H. Ray, M.D., San Mateo; Phillip E. Rothman, M.D., Los Angeles; E. J. Lamb, M.D., Santa Barbara.*

THERE is a striking tendency for children with lead poisoning to develop an encephalitis which has a poor prognosis. Because of its relatively frequent occurrence, the preventive aspect of the problem should be greatly stressed.

It has been observed that children may ingest small amounts of lead over a prolonged period of time without manifestation of symptoms. Intoxication following the ingestion of lead appears to be dependent on a number of factors. Of primary importance is the amount of lead ingested, and the period of time over which it is taken into the body. The absorption of small amounts of lead by all persons seems to be of a normal occurrence, and is said to be unaccompanied by danger.[1] An increase in the amount of lead ingested, or the continuation of absorption over a long period of time associated with storage in bones, gives rise to potential danger. There is observed considerable individual variation in tolerance to this metal. Some children, after the ingestion of moderate amounts, rapidly develop encephalitis. Others are capable of tolerating quite large amounts with minimal development of symptoms, but, however, with the deposition of abnormal amounts of lead in the bones.[2] Under certain circumstances, such as the occurrence of acute infection, the chemistry of the body may be changed in such a way as to cause the mobilization of the lead deposited in the bones in apparently inert form, and thereafter develop an acute intoxication. Lead is carried in the blood stream presumably as the phosphate, and is deposited in various organs, especially the bones, brain, liver, and pancreas. Lead deposited in the brain will cause central nervous symptoms. The severity of symptoms will vary with the quantity and rapidity of deposit. These symptoms of encephalitis may be the first indications of lead poisoning precipitated by an acute infection.

REPORT OF CASES

Four cases of lead encephalitis studied at the Pasadena Hospital were initiated by such infections as otitis media, mastoiditis, tonsillitis, and pertussis. None of these children, according to accurate histories, showed significant signs or symptoms of lead poisoning prior to the acute onset of the above mentioned infections. During the course of these infections, three of the four children developed violent convulsions, vomiting—frequently of the projectile type, threatening respiratory failure—and symptoms of cerebral edema. The fourth child only developed tremors, occasional vomiting, and gastro-intestinal disturbances. These children showed characteristic changes in the appearance of the red blood cells, excess amount of lead in the urine, lead lines at the ends of the diaphysis by x-ray, and spinal fluid under increased pressure.

Three of these children are living, two of whom have no apparent symptoms of lead poisoning. The third child, originally treated for otitis media, now has an ataxic gait, shows behavior changes, and has marked mental deterioration. The fourth child, originally having pertussis, died after one week of violent convulsions and symptoms of marked cerebral edema. Autopsy showed relatively large quantities of lead in most of the organs of the body, especially the brain tissue. This child died at the age of nine months.

The source of lead in two of the children was undetermined. In the other two children lead was ingested from play-pen and crib.

DIAGNOSIS

A diagnosis of lead poisoning can be made in children in the early stages of intoxication by the correlation of the history, physical signs, and laboratory data in conjunction with x-ray findings. The clinical picture is the usual one seen in lead poisoning—vomiting, abdominal pain, anemia, central nervous system symptoms such as irritability, ataxic gait, stupor, twitching or convulsions, peripheral nerve lesions, and sometimes behavior changes. Lead encephalitis must be distinguished from other types of diseases with cerebral involvement, notably various forms of encephalitis and meningitis. It is the opinion of McKhann and others that the cerebral manifestations are evidences only of the cerebral edema, and not pathognomonic of lead intoxication.